

respectively designated "Version of Claims with Markings to Show Changes Made," and "Amendments to Specification with Markings to Show Changes Made."

Regarding the Office Action:

In the Office Action, the Examiner objected to the specification and claims 1 and 8, and required corrections; rejected claims 1 – 4, 7 – 11, 14, and 15 under 35 U.S.C. § 102(b) as anticipated by Livesay, et al. (PCT Int'l Publication No. WO 96/36070) ("Livesay-1"); rejected claims 6 and 13 under 35 U.S.C. § 103(a) as unpatentable over Livesay-1 in view of Livesay, et al (U.S. Patent No. 5,003,178) ("Livesay-2"); rejected claims 16 – 19 under 35 U.S.C. § 103(a) as unpatentable over Livesay-1 in view of Goo, et al. (U.S. Patent No. 5,989,983); and objected to claims 5 and 12 as dependent upon a rejected base claim, but indicated they would be allowable if rewritten in independent form. As a result of this Amendment, claims 1 – 19 remain pending.

Applicants appreciate the Examiner's thorough examination of this application, especially the detailed citations which aided Applicants in reviewing the Examiner's comments. Applicants respectfully traverse the objections and rejections, as detailed above, for the following reasons.

Regarding the objection to the Specification and Claims 1 and 8:

In response to the Examiner's objection to the specification, Applicants have amended the specification consistent with the Examiner's required corrections and to correct a typographical error on page 14. For the Examiner's reference, all changes are evident in the attached Appendix designated "Amendments to Specification with Markings to Show Changes Made." Applicants submit that these amendments to the specification do not constitute new matter.

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Applicants have also amended claims 1 and 8, in part to include the Examiner's required correction that the phrase "one of parameter" be replaced with "one of the parameters," thereby conforming with the Examiner's required corrections. Applicants have also amended claim 1 to more appropriately define the present invention. Support for the amendment to claim 1 can be found in the specification, for example, on p. 31, ll. 11 – 13. Applicants also submit these amendments to claims 1 and 8 do not constitute new matter.

In making various references to the specification set forth above, it is understood that Applicants are in no way intending to limit the scope of the claims to the exemplary embodiments described in the specification and illustrated in the drawings. Rather, Applicants expressly affirm that they are entitled to have the claims interpreted broadly, to the maximum extent permitted by statute, regulation, and applicable case law.

Applicants therefore deem the Examiner's objections to the specification and claims 1 and 8 overcome, and accordingly request withdrawal of the objections.

Regarding the rejection of claims 1 – 4, 7 – 11, 14, and 15 under 35 U.S.C. § 102(b):

Applicants respectfully traverse the rejection of claims 1 – 4, 7 – 11, 14, and 15 under 35 U.S.C. § 102(b) as anticipated by Livesay-1.

Applicants point out that in order to properly establish that Livesay-1 anticipates Applicants' claimed invention under 35 U.S.C. § 102(b), each and every element of each of the claims in issue must be found, either expressly described or under principles of inherency, in that single reference. Furthermore, "[t]he identical invention must be shown in as complete detail as is contained in the ... claim." See M.P.E.P. § 2131, p. 2100-69, quoting *Richardson v. Suzuki Motor Co.*, 868 F.2d 1126, 1236, 9 U.S.P.Q.2d 1913, 1920 (Fed. Cir. 1989). Regarding the 35

U.S.C. § 102(b) rejection, Livesay-1 does not teach each and every element of Applicants' present invention as claimed.

Applicants' independent claim 1 recites a combination of elements, among them:

“changing at least one of the parameters selected from the group consisting of pressure in the reactor chamber, temperature of the substrate, type of gas having the substrate exposed thereto, flow rate of a gas introduced into the reactor chamber, position of the substrate, and quantity of electrons incident to the substrate per unit time when the electron beam is being irradiated on the substrate, wherein the substrate temperature is changed by a predetermined amount during the electron beam irradiating process.”

Applicants' independent claim 1 is clearly different from Livesay-1. Unlike Applicants' claimed invention, Livesay-1 does not disclose these elements of Applicants' claim 1.

Regarding the rejection of claim 1, the Examiner alleged, “[Livesay-1] discloses ... heating the substrate in a reactor chamber (pg. 8[,] lines 19-25), changing at least one [] parameter selected from the group consisting of ... temperature of the substrate (pg. 9[,] lines 15-23), ...” (Office Action, p. 2). Applicants note the Examiner points to Livesay-1's disclosure that “[i]n the preferred embodiment of the invention the wafer is simultaneously heated by the infrared lamps and irradiated by the electron beam throughout the entire process” (Livesay-1, p. 9, ll. 17 – 19).

Applicants note that claim 1 distinguishes over Livesay-1, in part because claim 1 recites “wherein the substrate temperature is changed by a predetermined amount during the electron beam irradiating process.” In contrast to Livesay-1, Applicants' substrate temperature is not held constant during the electron beam irradiating process. Thus, Livesay-1 does not disclose each and every element of Applicants' claim 1.

Since Livesay-1 does not disclose each and every element of Applicants' independent claim 1, Livesay-1 does not anticipate Applicants' claimed invention. In addition to Livesay-1 not anticipating the present invention, Livesay-1 does not disclose an identical invention, let alone in as complete detail as contained in Applicants' independent claim 1. Applicants submit that the Examiner has not met these essential requirements of anticipation for a 35 U.S.C. § 102(b) rejection.

In response to the Examiner's rejection of dependent claims 2 – 4, 7 – 11, 14, and 15: "Examiners are reminded that a dependent claim is directed to a combination including everything recited in the base claim and what is recited in the dependent claim. It is this combination that must be compared with the prior art, exactly as if it were present as one independent claim." M.P.E.P. § 608.01(n)(III), p. 600-77.

Therefore, since Applicants have shown above that independent claim 1 is allowable, Applicants also submit that dependent claims 2 – 4, 7 – 11, 14, and 15 are also allowable at least by virtue of their dependence from allowable base claim 1.

In summary, since Livesay-1 does not disclose each and every element of Applicants' present invention, Livesay-1 does not anticipate independent claim 1 or dependent claims 2 – 4, 7 – 11, 14, and 15. As such, Applicants respectfully submit that claims 1 – 4, 7 – 11, 14, and 15 are patentable over Livesay-1. Therefore, the rejection is improper and should be withdrawn.

Regarding the rejection of claims 6 and 13 under 35 U.S.C. § 103(a):

Applicants respectfully traverse the rejection of claims 6 and 13 under 35 U.S.C. § 103(a) as unpatentable over Livesay-1 in view of Livesay-2. Applicants respectfully disagree with the Examiner's arguments and conclusions, and respectfully submit that a *prima facie* case of obviousness has not been established.

In order to establish a *prima facie* case of obviousness, the M.P.E.P. sets forth that three basic criteria must be met. First, the prior art reference (or references when combined) must teach or suggest all the claim elements. Furthermore, “[a]ll words in a claim must be considered in judging the patentability of that claim against the prior art.” See M.P.E.P. § 2143.03, 8th Ed., Aug. 2001, p. 2100-126, quoting *In re Wilson*, 165 U.S.P.Q. 494, 496 (C.C.P.A. 1970). Second, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify a reference or to combine reference teachings. Third, there must be a reasonable expectation of success. See M.P.E.P. § 2143, pp. 2100-122 – 127.

Furthermore, Applicants note dependent claims 6 and 13 are directed to a combination including everything recited in the base claim and what is recited in the dependent claim. See M.P.E.P. § 608.01(n)(III), p. 600-77. Livesay-2, taken alone or in combination with Livesay-1, still does not teach or suggest those recitations of Applicants’ independent claim 1 not taught or suggested by Livesay-1.

Applicants have already previously explained why Livesay-1 does not teach or suggest all the recitations of Applicants’ independent claim 1, and therefore, for at least the reasons stated above, Applicants’ dependent claims 6 and 13 are not obvious.

In addition, the Examiner admitted deficiencies in Livesay-1, in that it “does not teach that the position of the substrate is changed in a range from not less than 50 mm to not more than 120 mm in distance from an electron beam generating section that generates the electron beam” (Office Action, p. 5), yet alleges Livesay-2 would cure this deficiency. Nevertheless, Applicants note that Livesay-2 still does not cure the deficiencies of Livesay-1 pertaining to the elements of independent claim 1.

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The Examiner alleged Livesay-2 “teaches in figure 3 adjusting the position of the substrate (30) in a range from not less than 50 mm to not more than 120 mm in distance from an electron generating section that generates the electron beam (col. 6, lines 15-26)” (Office Action, p. 5). Applicants note, however, that Livesay-2 does not cure the deficiencies of Livesay-1, in part because Livesay-2 does not teach or suggest that “the substrate temperature is changed by a predetermined amount during the electron beam irradiating process” (Applicants’ claim 1). In contrast, Livesay-2 discloses “[e]lectron beam exposure of the resist provides nonthermal means of crosslinking and hardening the resist. The *substrate stays at room temperature* yet the resulting exposed resist is fully crosslinked without pattern flow” (Livesay-2, col. 7, ll. 31 – 35, emphasis added). This is clearly different from Applicants’ claimed invention. Thus Livesay-1 or Livesay-2, taken alone or in combination, cannot produce Applicants’ claimed invention.

The Examiner has therefore not met at least one of the essential criteria for establishing a *prima facie* case of obviousness, wherein “the prior art reference (or references when combined) must teach or suggest all the claim limitations.” *See* M.P.E.P. §§ 2142, 2143, and 2143.03.

Even though Livesay-1 does not teach or suggest all the features of Applicants’ claimed invention, the Examiner’s application of Livesay-2 as a reference for a rejection of dependent claims 6 and 13 does not render the recitations of Applicants’ claims obvious. Even if the Examiner’s characterization of Livesay-1 or Livesay-2 (*See* Office Action, pp. 4 – 5) were correct (which Applicants dispute), this still does not establish that there would have been the requisite suggestion or motivation to modify Livesay-1 with Livesay-2. For example, Livesay-1 discloses that “[i]n the preferred embodiment of the invention the wafer is simultaneously heated by the infrared lamps and irradiated by the electron beam throughout the entire process” (Livesay-1, p. 9, ll. 17 – 19). In contrast, Livesay-2 discloses that “[t]he substrate stays at room

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temperature..." (Livesay-2, col. 7, ll. 33 – 34). Thus, there can be no motivation to combine these references, as they do not teach or suggest the elements of Applicants' independent claim 1 or dependent claims 6 and 13 (by virtue of their dependence from claim 1).

Therefore, for the reasons just presented, there is no suggestion or motivation to modify Livesay-1 with Livesay-2 (or vice versa) to produce Applicants' claimed invention. Even if the Examiner's allegations that "it would have been obvious... to modify the process of Livesay-1" (Office Action, p. 5), were true (which Applicants dispute), this still does not establish that there would have been the requisite suggestion or motivation to modify either Livesay-1 or Livesay-2 to produce Applicants' claimed invention. "The mere fact that references can be combined or modified does not render the resultant combination obvious unless the prior art also suggests the desirability of the combination." M.P.E.P. § 2143.01, p. 2100-124, citing *In re Mills*, 916 F.2d 680, 16 USPQ2d 1430 (Fed. Cir. 1990) (emphasis in original).

Since Livesay-1 and Livesay-2, taken alone or in combination, do not teach or suggest all the recitations of Applicants' claimed invention, and there can be no suggestion or motivation in the cited references to modify them. Applicants submit that the cited references do not suggest the desirability of their modification to produce Applicants' present invention.

Thus, dependent claims 6 and 13 are allowable for the reasons presented herein, in addition to being allowable at least by virtue of their dependence from allowable base claim 1. Therefore, Applicants respectfully submit that the Examiner should withdraw the improper 35 U.S.C. § 103(a) rejection.

Regarding the rejection of claims 16 – 19 under 35 U.S.C. § 103(a):

Applicants respectfully traverse the rejection of claims 16 – 19 under 35 U.S.C. § 103(a) as unpatentable over Livesay-1 in view of Goo.

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Applicants respectfully disagree with the Examiner's arguments and conclusions, and submit that a *prima facie* case of obviousness has not been made.

Furthermore, Applicants note dependent claims 16 – 19 are directed to a combination including everything recited in the base claim and what is recited in the dependent claim. *See* M.P.E.P. § 608.01(n)(III), p. 600-77.

Applicants have already demonstrated above in that Livesay-1 does not teach or suggest all the recitations of Applicants' independent claim 1. Therefore, for at least the reasons stated above, Applicants' claims 16 – 19, dependent from claim 1, are not obvious over Livesay-1 standing alone.

Moreover, Goo, taken alone or in combination with Livesay-1, still does not teach or suggest those recitations of Applicants' independent claim 1 (and therefore claims 16 – 19 as well) not taught or suggested by Livesay-1. While Goo teaches "curing the SOG layer by irradiating the SOG layer with an electron beam [and] [t]he microelectronic substrate is preferably simultaneously heated to a temperature below about 500°C" (Goo, col. 3, ll. 61 – 63), Goo also teaches that "[w]hen the electron beam 18 is used, the curing can be performed at room temperature" (Goo, col. 5, ll. 31 – 35). Regardless of whether Goo teaches "embedding a wire whose main material is Cu" (Office Action, p. 6), Goo still does not teach or suggest Applicants' claimed changing the substrate temperature by a predetermined amount during the electron beam irradiating process. *See* Applicants' claim 1.

The Examiner admitted additional deficiencies in Livesay-1, stating that Livesay-1 "does not teach that the insulation film is a polymethylsiloxane film" and "does not teach that the wire's main material is Cu on a surface of an insulation film" (Office Action, p. 6). In addition, Applicants note, despite the Examiner's subsequent allegations that it would have been obvious

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to apply Goo to Livesay-1's disclosure to allegedly cure Livesay-1's deficiencies, Livesay-1 and Goo's disclosures are not combinable to produce Applicants' claimed invention, in part because Goo does not teach or suggest all of the features of Applicants' claim 1 not taught or suggested by Livesay-1. Thus, the Examiner cannot apply Goo to Livesay-1 in an attempt to produce Applicants' claimed invention.

The Examiner has therefore not met at least one of the essential criteria for establishing a *prima facie* case of obviousness, wherein "the prior art reference (or references when combined) must teach or suggest all the claim limitations." See M.P.E.P. §§ 2142, 2143, and 2143.03.

Since Livesay-1 and Goo, taken alone or in combination, do not teach or suggest all the recitations of Applicants' claimed invention, there can be no suggestion or motivation *in the cited references* to modify Livesay-1 with Goo. Applicants submit that the cited references do not suggest the desirability of their modification to produce Applicants' present invention. Thus, Applicants submit that the Examiner's reliance on Livesay-1 and Goo fails to establish *prima facie* obviousness.

Thus, dependent claims 16 – 19 are allowable for the reasons presented herein, in addition to being allowable at least by virtue of their dependence from allowable base claim 1. Therefore, Applicants respectfully submit that the Examiner should withdraw the 35 U.S.C. § 103(a) rejection.

Conclusion:

For the reasons articulated herein, Applicants submit that independent claim 1 is allowable. In addition, dependent claims 2 – 19 are also allowable at least by virtue of their dependence from allowable base claim 1.

In view of the foregoing, Applicants request reconsideration of the application and submit that the objections and rejections detailed above should be withdrawn. A favorable action is requested.

Should the Examiner continue to dispute the patentability of the claims after consideration of this Amendment, Applicants invite the Examiner to contact Applicants' undersigned representative by telephone to discuss any remaining issues.

Please grant any extensions of time under 37 C.F.R. § 1.136 required in entering this response. If there are any fees due under 37 C.F.R. § 1.16 or 1.17, which are not enclosed, including any fees required for an extension of time under 37 C.F.R. § 1.136, please charge such fees to our deposit account 06-0916.

Respectfully submitted,

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Dated: December 12, 2002

By: 

Richard V. Burginjian
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APPENDIX TO AMENDMENT OF December 12, 2002

Amendments to Specification with Markings to Show Changes Made

AMENDMENTS TO THE SPECIFICATION:

Please amend the specification as follows:

1. Please replace the paragraph beginning on page 14, line 20, and ending on page 15, line 3, with the following new paragraph:

--The method according to the present embodiment is significantly different from methods disclosed in the previously described PCT National Publication HEI No. [10-505670] 11-505670, PCT National Publication HEI No. 11-506872, and Jpn. Pat. Appln. KOKAI Publication No. 10-107026 or the like in that the pre-heat treatment or post-heat treatment that is continuous carried out with the above electron beam irradiation, and the at least one parameters is changed during these treatments in a chamber that is the same as a reactor chamber for carrying out the electron beam irradiation treatment.--

2. Please replace the paragraph beginning on page 26, line 24, and ending on page 27, line 3, with the following new paragraph:

--Further, in the insulation film formed by process C, there appears a large peak caused by [H₂O] H₂O bonding in the vicinity of a wave number of 3500 cm⁻¹ and Si-OH bonding in a vicinity of a wave number of 980 cm⁻¹, but in the insulation films formed by the process of present embodiment and process A, almost no peak appears in the vicinity of the above wave number.--

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3. Please replace the paragraph beginning on page 27, line 5, with the following new paragraph:

--From these facts, in the case process C, it is considered that a sufficient dehydration reaction is not carried out, and a number of Si-OH bonding and $[H_2 O] \underline{H_2O}$ remains in the insulation film.--

4. Please replace the paragraph beginning on page 27, line 20, and ending on page 28, line 10, with the following new paragraph:

--On the other hand, in the insulation film formed by the process of the present embodiment, there appears neither a peak caused by $[H_2 O] \underline{H_2O}$ bonding in the vicinity of the wavelength of 3500 cm^{-1} nor a peak caused by Si-OH bonding in the vicinity of the wavelength of 980 cm^{-1} . Namely, heat treatment is carried out at the same time as the electron beam irradiation, and changing the pressure, whereby bonding between the CH_3 group and the primary chain in a molecule is cut, and a dangling bond is formed. In addition, dehydration reaction effectively occurs due to heat treatment, whereby the dangling bond is coupled with another molecule or group without being coupled with the OH group. This is considered as a reason why the insulation film formed by the process of the present embodiment has low relative dielectric constant and sufficient crack resistance property by the formation of the rigid network.--

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APPENDIX TO AMENDMENT OF December 12, 2002

Version of Claims with Markings to Show Changes Made

AMENDMENTS TO THE CLAIMS:

Please amend claims 1, 6, and 8 as follows:

1. (Amended) A method of manufacturing a semiconductor device comprising:

preparing a substrate to be treated; and

forming an insulation film above the substrate, which includes applying an insulation film raw material above the substrate, the insulation film raw material including a substance or a precursor of the substance, the insulation film comprising the substance, curing the insulation film raw material by irradiating an electron beam on the substrate while heating the substrate in a reactor chamber, and changing at least one of [parameter] the parameters selected from the group consisting of pressure in the reactor chamber, temperature of the substrate, type of gas having the substrate exposed thereto, flow rate of a gas introduced into the reactor chamber, position of the substrate, and quantity of electrons incident to the substrate per unit time when the electron beam is being irradiated on the substrate,

wherein the substrate temperature is changed by a predetermined amount during the electron beam irradiating process.

6. (Amended) A method of manufacturing a semiconductor device according to claim

[5] 1, wherein the position of the substrate is changed in a range from not less than 50 mm to not more than 120 mm in distance from an electron beam generating section that generates the electron beam.

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8. (Amended) A method of manufacturing a semiconductor device according to claim 1, further comprising:

at least one of pre-heat treatment which carried out before curing the insulation film raw material and post-heat treatment which carried out after curing the insulation film raw material in the reactor chamber, changing at least one of [parameter] the parameters selected from the group consisting of pressure in the reactor chamber, temperature of the substrate, type of gas having the substrate exposed thereto, flow rate of gas introduced into the reactor chamber, and position of the substrate when the at least one of the pre-heat treatment and the post-heat treatment is being carried out.

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